AMENDMENTS

Version with markings to show changes made

Replace the paragraph beginning on P. 2, line 15, with the following paragraphs

-- The invention is intended to create a doctor unit in a paper machine, which can be used to monitor the wear and blade load of the doctor blade and the general condition of the other structures, also while the paper machine is running. The apparatus of the doctor unit can also be used during servicing or when making basic adjustments, when the paper machine is stopped. The settings of the doctor unit can then be made more easily and correctly than by previous methods. [The characteristic features of the present invention appear in the accompanying Claims.]

A doctor unit in a paper machine includes a blade carrier having a blade holder, and a doctor blade fittable on the blade holder for doctoring a roll or similar moving surface, the doctor unit is characterized in that either the blade holder or doctor blade includes at least one sensor installed inside the construction or on its surface, and the sensor is arranged to measure either or both of the wear and stress in the blade holder or doctor blade.

In one embodiment at least one optical fiber is adapted as a sensor and installed inside the blade holder or doctor blade. The doctor unit may include light transmitting devices, at one end of the doctor unit, connected to the optical fibers, and light receiving devices at the other end. In another arrangement the blade holder may include a top plate, in which there are one or more optical fibers arranged in essentially the transverse direction of the doctor unit and extending from one end of the top plate to the other.

Preferably optical fibers installed inside the doctor blade and extending over the entire length of the doctor blade are arranged essentially transversely to the doctor unit 0.5 - 10 mm from each other. There may also be 1 - 15 optical fibers of the blade holder or the doctor blade. Each optical fiber includes filaments acting as sensory organs and the optical fiber is connected to an electrical crystal, which is arranged to send a signal when the resistance in the optical fiber changes.

In an alternative embodiment the surface of the blade holder or doctor blade includes at least one of a pressure-sensitive sensor and/or stress-strain sensor arranged to measure the blade load. Herein sensors are arranged essentially over the entire width of the doctor unit in the area of contact between the top plate belonging to the blade holder and the doctor blade.

The pressure-sensitive sensor may be one of a PVDF membrane sensor and an EMF sensor operating on the piezoelectric principle. 1 - 10 PVDF sensors may be fitted over the width of the doctor unit per meter of width of the doctor unit.

The duration of sensor measurement in connection with the blade holder or the doctor blade is configurable between momentary and continuous duration when the sensor is connected to a selected monitoring system.

At suitable locations in the doctor unit sensors are arranged, which are, as such, simple, but which, however, provide accurate information on the condition of the doctor unit even when running. The sensors do not affect the operation of the doctor unit and are easy to calibrate. The sensors and their locations are selected according to the variable to be measured. If desired, all the various sensors can be placed in a single doctor unit, in which case information on both the wear of the doctor blade and on the blade load will be obtained. At the same time, it is possible to monitor the general condition of the structures of the doctor unit.

On the other hand, by selecting a certain type of sensor, it is possible to concentrate on monitoring a single important variable. Existing doctor units can also be easily utilized when creating a doctor unit according to the invention. --

Replace the paragraph beginning on P. 3, line 4, with the following paragraph

-- In the following, the invention is disclosed in detail by reference to the accompanying drawings showing some embodiments of the invention[, in which claims]. --

Replace the paragraph beginning on P. 3, line 28, with the following paragraph

-- Figures 1 - 3 and 5 show a some different embodiments of a doctor unit according to the invention arranged in connection with a roll 13. The embodiments shown here as examples have a basic construction that is, as such, that of a conventional hose-loaded doctor unit. The invention can also be applied in fixed, i.e. stiff blade holders, in which the doctor blade is loaded by rotating the beam around its bearings. The sensors 18 can then only be used at the ends of the beam, to measure the angle of rotation or movement and the corresponding average wear of the blade. In this case, however, local wear values cannot be observed in the same way as they can in hose-loaded blade holders. A hose-loaded doctor unit includes a blade carrier 10 attached to the doctor-unit frame (not shown) and a blade holder 11 arranged in it. Fitted to the blade holder 11 is the actual doctor blade 12, by means of which the surface of roll 13 is doctored. The surface may also be some other moving surface[, which it is wished to doctor]. In a hose-loaded doctor unit, blade holder 11 is jointed rotatably to blade carrier 10. Here the doctor unit is shown in cross-section, so that joint 14 is shown by broken lines. In addition, there are loading hoses 15 and 15' between blade carrier 10 and blade holder 11, by means of which doctor blade 12 is rotated around joint 14. The operation of the loading hoses is[, as such,] known. --

Replace the paragraph beginning on P. 7, line 22, with the following paragraph

-- [Besides] In addition to the construction shown in Figure 1, the wear of the doctor blade can be monitored by using another kind of sensor[s] installed in the doctor unit. In the embodiment in Figure 2, inductive sensors 18 are installed in both the blade holder 11 and the blade carrier 10. Other kinds of sensors, which measure distance, movement, or angle of rotation, can also be used. The sensors 18 are calibrated for a certain distance. The brushes 19 shown by broken lines depict the direction of observation of the sensors 18, for example, when the sensors are in the rear of the blade holder. As doctor blade 12 continues to wear, the distance between blade holder 11 and blade carrier 10 continually increases. When the distance exceeds a set limit, the sensor emits a signal. Thus, sensors 18 act as a kind of limit switch, which report that the doctor blade will soon be worn out. This facilitates the planning of maintenance shutdowns and prevents the damage caused by the sudden wearing out of the doctor blade. To measure local differences and avoid erroneous messages, several sensors are installed in the doctor unit. As the doctor blade typically wears mostly in the middle, it is preferable to install the sensors in the center of the doctor unit. The sensors may also be on the front side of the blade holder, though the installation of the sensors is easier in the manner shown in Figure 2. The measurement method disclosed above is applied mainly only in hose-loaded jointed blade holders. --

Replace the paragraph beginning on P. 9, line 21, with the following paragraph

-- Figure 4a shows the embodiment of Figure 1 seen from above. The only part of the doctor unit shown is the doctor blade 12, which as usual has worn mostly in the center. During manufacture, optical fibers 16, shown with broken lines, have been installed in doctor blade 12. According to the invention, the doctor unit includes light-sending devices 20 at one end of the doctor unit and light-receiving devices 20' at the other end. These devices are [as

such] known and in this case they are in principle attached directly to doctor blade 12. A corresponding construction can also be applied to monitor the condition of the top plate. The figures do not show the rest of the condition-monitoring equipment, as this varies greatly with different applications. However, what is essential is that during operation all the sensors provide explicit information, which can be easily utilized with the aid of existing electronic apparatus[es]. --

Replace the paragraph beginning on P. 10, line 17, with the following paragraph

-- Figure 4b shows doctor blade 12 and a pressure-sensitive sensor 21 installed on its surface. According to the invention, the pressure-sensitive sensor is a PVDF membrane sensor that is [as such] known. The utilization of such a membrane sensor is also disclosed in Finnish patent 86771. Such a sensor will provide an analog voltage signal proportional to the force and thus also the pressure, which can easily be utilized. The sensors are also easy to calibrate. In addition, the sensors are applicable to a very wide range of forces. The sensors may be separate membrane sensors or assembled to form a single long membrane element, as in Figure 4b. This facilitates the cabling of the sensors. Figures 4b and 4c show only the cabling 22 of a single membrane sensor 21. An EMF sensor operating on the piezoelectric principle, for example, can also be used as a pressure-sensitive sensor. --

Replace the paragraph beginning on P. 11, line 13, with the following paragraph

-- Generally, 1 - 10, preferably 2 - 6 PVDF membrane sensors are fitted to each meter of width of the doctor unit. This allows the [real] <u>actual</u> blade load of the doctor blade to be determined in zones. An increase in the number of sensors will naturally give a more precise descriptor of the transverse loading profile, but it will also increase the cabling. --